computational complexity of the present method is only 5.21% of the SLM method. When the number of candidate signal is 32 and the sampling factor J=1, the PAPR suppression effect of the present method is better than that of the PTS method. From the Table 3, it can be seen that the computational complexity of the present method is 41.67% of that of PTS.

[0073] FIG. **9** is a comparison of the PAPR reduction by the SLM method, the PTS method, and the method of the present invention when the number of candidate signals is 32 and the sampling factor J=4. When computing the PAPR distribution characteristics of OFDM signals, using the sampling factor J=4 can closely simulate the continuous feature of OFDM signals. Comparing the PAPR distribiton from FIG. **8** (sampling factor J=1) and FIG. **9** (sampling factor J=4), it can be seen that the PAPR of each method has about 0.5 dB increase when sampling factor is 4.

[0074] While the present invention has been described in some detail for purposes of clarity and understanding, one skilled in the art will appreciate that various changes in form and detail can be made without departing from the true scope of the invention. All figures, tables, appendices, patents, patent applications and publications, referred to above, are hereby incorporated by reference.

What is claimed is:

1. A method for reducing peak-to-average power ratio (PAPR) in a fractional Fourier transform-orthogonal frequency division multiplexing (FRFT-OFDM) communication system, comprising the steps of:

1) at a transmitting end of the FRFT-OFDM communication system, performing an N-point inverse discrete fractional Fourier transform (IDFRFT) of digitalized complex input data X of length N and converting it into the time domain to obtain FRFT-OFDM subcarrier signal x(n), wherein n is 1, 2, . . . , N;

2) using a multiplexer to perform a p-order chirp periodic extension of the FRFT-OFDM subcarrier signal x(n) to obtain an extended chirp sequence, $x((n))_{P,N}$, wherein chirp refers to a linear frequency modulation and p is the order of Fractional Fourier Transform, and wherein the conversion equation for the p-order chirp periodic extension is:

$$x(n-N)e^{j\frac{1}{2}\cot\alpha\square(n-N)^2\Delta t^2} = x(n)e^{-j\frac{1}{2}\cot\alpha\square n^2\Delta t^2}$$

wherein $\alpha=p\pi/2$, Δt is the sampling interval;

3) shifting $x((n))_{P,N}$ to the right by iM (i is 1, 2, . . . , L) points to get $x((n-iM))^{P,N}$, which further multiplies by R_N (n) to obtain chirp circular displacement of FRFT-OFDM signal, $x((n-iM))_{P,N}R_N(n)$, wherein L is the length of the random phase sequence; M=N/L,

$$R_N(n) = \begin{cases} 1 & 1 \le n \le N-1 \\ 0 & \text{other} \end{cases};$$

4) multiplying $x((n-iM))_{P,N}R_N(n)$ by

$$\eta(n, i) = e^{j\frac{1}{2}\cot\alpha\square[-2\square iM\square n+(iM)^2]\Delta t^2}$$

point-by-point to obtain $\phi(n,i)$ as the following:

$$\phi(n,i)=x((n-iM))_{P,N}R_N(n)\square\eta(n,i), i=0,1 \ldots L-1. \quad n=0,1, \ldots, N-1$$

5) multiplying $\phi(n,i)$ by weighting factors, $r^{(l)}(i)$, and using a combiner to obtain candidate signals $\tilde{x}^{(l)}(n)$ of FRFT-OFDM in time domain as the following:

$$\tilde{x}^{(l)}(n) = \sum_{i=0}^{L-1} r^{(l)}(i)\square\varphi(n, i),$$

n=0,1 . . . N−1, l=1,2 , . . . S

wherein $r^{(l)}(i)$ is the weighting factor with L-length, and S is the number of alternative Fractional random phase sequence;

6) transmitting the weighting factor $r(i)_{opt}$ that makes PAPR of candidate signals minimum as sideband information of FRFT-OFDM signals, wherein

$$r(i)_{opt} = \underset{\{r^{(1)}(i),\ldots,r^{(S)}\}}{\operatorname{argmin}} PARP \{\tilde{x}^{(l)}(n)\}$$

8) using a Digital-to-Analog Converter to convert the transmitting FRFT-OFDM signals with minimum PAPR to analog signals which are further amplified by a High-Power Amplifier after modulated by carrier; and

9) submitting the amplified analog signals to a transmitting antenna.

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